

Multi-use of offshore wind farms with low-trophic aquaculture can help achieve global sustainability goals

The coastal zone is heavily impacted by human activities and the demand for space is continuously increasing. European coastal seas host a wide range of different competitive uses, such as shipping, oil and gas exploitation, wind farms, mining, recreational activities, aquaculture, fishing, and conservation. This exploitation of the coastal zone substantially increases the stress on marine ecosystems, leads to spatial conflicts, and hinders the expansion of many of these uses. Sustainable development of the blue economy requires area-efficient use of marine space and innovative solutions demonstrating net emission capture thereby contributing to mitigating eutrophication and climate change.

Multi-use of offshore wind farms (OWF) with low-trophic aquaculture (LTA) could provide sustainable energy, nutritious seafood, and restorative ecosystem services through nutrients and carbon capture and utilization. This potential was investigated in the projects OLAMUR and Wind@sea. In a transition zone between marine and brackish seas, our models predicted that allocating 10% of projected wind farm areas to blue mussel and sugar kelp aquaculture in the North Sea - Baltic Sea transition zone could yield 18 t-fresh weight ha⁻¹ yr⁻¹. Total carbon captured and harvested from seaweed biomass and mussel shells would equal 40% of the carbon dioxide emissions from the Danish agricultural sector.

Global LTA production is projected to increase by 132% compared to current production in a realistic scenario of OWF development. Pessimistic and optimistic projections predicted a 22% and 400% increase, respectively. With technological and regulatory challenges still to be addressed, these findings demonstrate a vast potential of multi-use in offshore areas, which can generate blue biomass with fewer user conflicts, while mitigating eutrophication and climate change, thereby supporting multiple global sustainable development goals. The study is published in Maar et al. 2023. *Communications Earth & Environment*. 4:447. <https://www.nature.com/articles/s43247-023-01116-6>.

Authors: Marie Maar^{*1}, Andreas Holbach¹, Teis Boderskov^{2,3}, Marianne Thomsen^{4,5}, Bela H. Buck⁶, Jonne Kotta⁷, Annette Bruhn^{2,3}

- 1) Department of Ecoscience, Aarhus University, Frederiksborgvej 399, 4000 Roskilde, Denmark
- 2) Department of Ecoscience, Aarhus University, C.F. Møllers Allé, building 1131, Aarhus, Denmark
- 3) Centre for Circular Bioeconomy (CBIO), Aarhus University, Aarhus, Denmark
- 4) Department of Food Science, University of Copenhagen, Frederiksberg, Denmark
- 5) Green Solution Center (GSC), University of Copenhagen, Frederiksberg, Denmark
- 6) Marine Aquaculture, Shelf Sea Systems Ecology, Biosciences, Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research (AWI), Bremerhaven, Germany
- 7) Applied Marine Biology & Aquaculture, University of Applied Sciences Bremerhaven, Bremerhaven, Germany
- 8) Estonian Marine Institute, University of Tartu, Tallinn, Estonia

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Contact information: Marie Maar, Department of Ecoscience, Aarhus University, Frederiksborgvej 399, 4000 Roskilde, Denmark, e-mail: mam@ecos.au.dk